

Hydrogen Fuel

Hydrogen is the simplest and lightest of the elements, normally a colorless, odorless highly flammable gas. It is one of the most abundant elements in the earth's crust. It occurs rarely in its free state but is part of many compounds from which it can be readily separated – from water by electrolysis, from natural gas or other hydrocarbons by reaction with steam or by burning, and from acids by reaction with active metals. Liquid hydrogen is rocket fuel. Hydrogen was used to fuel dirigibles, but after the Hindenberg disaster, this was abandoned.

The National Hydrogen Association says that "hydrogen technology has been exhumed from basic laboratory research,"* due primarily to international interest in fuel cell vehicles. The association calls for development of universal codes and standards to ensure safe use of hydrogen and development of a convenient fuel delivery and hydrogen supply infrastructure. It remains to be seen whether a hydrogen-based infrastructure will emerge.

BPA Activities to Date

BPA has sponsored three studies of the economics of producing hydrogen as a fuel from Columbia River water, in 1984, 1987 and 1991. Each study examined the cost of using light load hour electricity from federal dams to separate the hydrogen from oxygen in the water and produce liquid hydrogen fuel. The most recent study examined two uses of hydrogen, as fuel for a fuel cell, and as liquid hydrogen for industrial use. Neither was found cost-effective, based on a 15-mill value for the electricity used to electrolyze water into hydrogen and oxygen.

*"Mapping the Path to a Hydrogen Future." *National Hydrogen Association News*. Spring 1998.

Implications for BPA's Future

If hydrogen-based distributed generation should become cost-effective and common in the future, the need for power from the Federal Columbia River Power System for end uses could diminish over time.

If hydrogen were to become a common fuel, and if the cost of producing hydrogen through electrolysis went down or other factors changed the overall economics, BPA could use off-peak energy from the Federal Columbia River Power System to produce hydrogen from Columbia River water through electrolysis. The amount of water consumed would be negligible and would ultimately fall back into the Columbia watershed as rain or snow. Thus, BPA could become a producer of sustainable hydrogen fuel.

Why Hydrogen Fuel?

Hydrogen has long been seen as a potentially inexhaustible, clean power supply. Fuel cells that run on pure hydrogen produce no waste other than hot water. Similarly, when hydrogen is burned as a fuel, the only byproduct is water. The smoke from a hydrogen fire is pure steam. The water can be used to make more hydrogen, completing a renewable cycle. Hydrogen has a very high energy content.

The problems that have kept hydrogen from common use as a fuel include cost of separating hydrogen from other elements, storage, transportation, infrastructure, and public perception that hydrogen fuel is unsafe.

Hydrogen is commonly used as a fuel in welding, and as an industrial component in many products, from ammonia fertilizer to margarine.

